

10/586995

COHAUSZ & FLORACK

Patent- und Rechtsanwälte

WPO Rec'd PCT/PTO 21 JUL 2006

COHAUSZ & FLORACK • P.O. Box 10 18 30 • D - 40009 Düsseldorf

Kungl. Patent- och  
Registreringsverket  
Box 5055

S-10242 Stockholm

Bleichstraße 14  
D-40211 Düsseldorf

Telephone +49(0)211-90 49-00  
Facsimile +49(0)211-90 49-049

Dipl.-Ing. Rudolf Knauf  
Patentanwalt

Dr.-Ing. Ralph Schippan  
Patentanwalt

Dipl.-Ing. Andreas Thielmann  
Patentanwalt

Dr. rer. nat. Ralph Minderop  
Patentanwalt

Dipl.-Ing. Johannes Simons  
Patentanwalt

Dipl.-Phys. Gottfried Schöll  
Patentanwalt

Dr. rer. nat. Thomas Rox  
Patentanwalt

Erik Schäfer  
Rechtsanwalt

Ulrike Alice Ulrich  
Rechtsanwältin

Dr. rer. nat. (USA) Arwed Burrichter  
Patentanwalt

Dipl.-Ing. Alexandra Weyres  
Patentanwältin

Dipl.-Ing. Jérôme Krüger  
Patentanwalt

Dipl.-Ing. Philippe Walter  
Patentanwalt

Rebekka Schiffer  
Rechtsanwältin

Dipl.-Phys. Amd Ziebell  
Patentanwalt

International patent application PCT/IB2004/000164  
In the name of Nokia Corporation

In response to the Written Opinion dated February 9, 2006, a new set of claims is submitted, which is to replace the original set of claims.

It is respectfully requested that the examination is continued based on this new set of claims and under consideration of the following comments.

I.

New independent claim 1 is based on original claim 1, which has been restricted with the features of original claims 2 and 3.

New claims 2-8 correspond to original claims 4-10.

New independent claim 9 is based on original claim 11 and has been restricted in a corresponding manner as new independent claim 1.

Am Borsigturm 33  
D-13507 Berlin  
Telephone +49(0)30-43 09 45 6-0  
Facsimile +49(0)30-43 09 45 6-20

Dipl.-Ing. Hans-Joachim Meyer  
Patentanwalt

Dipl.-Ing. Mathias Karhuber  
Patentanwalt

mail@cohausz-florack.de  
www.cohausz-florack.de

## II.

Claim 1

The examiner considered claim 1 not to be based on an inventive step, when proceeding from document US 2003/0129958 A1 (D1) and considering in addition document EP 0 410 295 A (D2). The examiner conceded that document D1 does not disclose that an active mixer load circuit includes modulating means arranged for modulating a flicker noise produced by an active mixer load away from the signal band of a signal output by said down-conversion mixing component. She considered this feature to be known from document D2, though.

Even though applicant does not agree that a skilled person would have combined the teachings of documents D1 and D2 as assumed by the examiner, the features of original claims 2 and 3 have now been included in new claim 1. These features describe a concrete structure of the mixer load.

In the Written Opinion, the examiner considered the features of original claims 2 and 3 to be disclosed as well by document D2. This estimation is contested.

When proceeding from document D1, it is an objective problem to be solved how to provide an alternative solution compared to the one of document D2 for providing a better mixer linearity without increasing the flicker noise (application: page 6, 2nd paragraph).

This is achieved according to new claim 1 by arranging the modulating means, namely the employed switching element, externally to an operational amplifier of the active mixer load. It is obviously an advantage of this solution that it can be used with standard operational amplifiers.

Document D2, in contrast, presents an operational amplifier (Fig. 1), which includes chopper circuits (details in Fig. 2; col. 4, lines 12-36). Operational amplifiers with integrated chopping circuits, however, do not allow using standard operational amplifiers.

Thus, even when combining the teachings of document D1 and document D2, a skilled person will not achieve the same advantages as with the mixer circuit of claim 1.

As a skilled person combining the teachings of documents D1 and D2 would not have obtained any hint at the subject matter of new claim 1, new claim 1 has to be considered to be based on an inventive step.

Independent claim 9

The method of this claim comprises steps corresponding to the functions realized by the mixer of claim 1. Thus, the same comments apply, and also the subject matter of this claim has to be considered to be based on an inventive step.

Claims 2-8

Each of these claims refers back directly or indirectly to claim 1. Thus, also these claims have to be considered to be new and to be based on an inventive step.

III.

Summarized, it has been shown that at least the subject matter of the amended claims is not only new, but also based on an inventive step. It is therefore expected that a positive International Preliminary Report on Patentability can now be issued.



Alexandra Weyres

Patent Attorney

Encl.

c l a i m s

1. Mixer circuit (31) comprising:

- a down-conversion mixing component (33) arranged for down-converting an input radio frequency signal ( $I_{rf+}, I_{rf-}$ ); and
- an active mixer load circuit (34) connected to output terminals of said down-conversion mixing component (33), wherein said active mixer load circuit (34) includes an active mixer load (51, T<sub>1</sub>, T<sub>2</sub>) and modulating means (S<sub>1</sub>-S<sub>4</sub>);
- wherein said active mixer load includes a first transistor (T<sub>1</sub>), a second transistor (T<sub>2</sub>) and an operational amplifier (51), wherein a first output terminal of said down-conversion mixing component (33) is connected to a first input of said operational amplifier (51), wherein a second output terminal of said down-conversion mixing component (33) is connected to a second input of said operational amplifier (51), wherein a reference common mode voltage (VCMREF) is applied to a reference common mode voltage input of said operational amplifier (51), and wherein an output of said operational amplifier (51) is connected in parallel to a respective gate of said first transistor (T<sub>1</sub>) and said second transistor (T<sub>2</sub>); and
- wherein said modulating means (S<sub>1</sub>-S<sub>4</sub>) include a plurality of switching elements (S<sub>1</sub>-S<sub>4</sub>) arranged for connecting alternately on the one hand said

first output terminal of said down-conversion mixing component (33) via said first transistor (T1) and said second output terminal of said down-conversion mixing component (33) via said second transistor (T2) to ground (Gnd), and on the other hand said first output terminal of said down-conversion mixing component (33) via said second transistor (T2) and said second output terminal of said down-conversion mixing component (33) via said first transistor (T1) to ground (Gnd), for modulating a flicker noise produced by said active mixer load (51,T1,T2) away from the signal band of a signal ( $I_{bb+}$ ,  $I_{bb-}$ ) output by said down-conversion mixing component (33).

2. Mixer circuit (31) according to one of claims 1, wherein said down-conversion mixing component (33) is adapted to down-convert radio frequency current mode signals.
3. Mixer circuit according to one of claims 1, wherein said down-conversion mixing component is adapted to down-convert radio frequency voltage mode signals.
4. Receiver circuit (10) for receiving radio frequency signals and for providing corresponding down-converted signals, which receiver circuit (10) comprises a mixer circuit (31) according to one of the preceding claims.
5. Receiver circuit (10) according to claim 4, wherein at least said mixing circuit (31) and at least one component (15) of said receiver circuit (10) arranged

for processing digital baseband signals are integrated in a single chip (16).

6. Chip comprising at least a mixer circuit (31) according to one of claims 1 to 3.
7. Chip according to claim 6, wherein said mixer circuit (31) is implemented on said chip with a deep sub-micron semiconductor technology.
8. Apparatus comprising a mixer circuit (31) according to one of claims 1 to 3.
9. Method for use in a mixer circuit (31) comprising a down-conversion mixing component (33) and an active mixer load circuit (34), wherein said active mixer load circuit (34) includes an active mixer load, said active mixer load including a first transistor (T1), a second transistor (T2) and an operational amplifier (51), wherein a first output terminal of said down-conversion mixing component (33) is connected to a first input of said operational amplifier (51), wherein a second output terminal of said down-conversion mixing component (33) is connected to a second input of said operational amplifier (51), wherein a reference common mode voltage (VCMREF) is applied to a reference common mode voltage input of said operational amplifier (51), and wherein an output of said operational amplifier (51) is connected in parallel to a respective gate of said first transistor (T1) and said second transistor (T2), said method comprising:

- down-converting a received radio frequency signal ( $I_{rf+}, I_{rf-}$ ) by means of said down-conversion mixing component (33);
- controlling an output voltage of said down-conversion mixing component (33) by means of an active mixer load (51,T1,T2) of said active mixer load circuit (34); and
- modulating a flicker noise produced by said active mixer load (51,T1,T2) away from the signal band of said down-converted radio frequency signal ( $I_{bb+}, I_{bb-}$ ) by connecting alternately on the one hand said first output terminal of said down-conversion mixing component (33) via said first transistor (T1) and said second output terminal of said down-conversion mixing component (33) via said second transistor (T2) to ground (Gnd), and on the other hand said first output terminal of said down-conversion mixing component (33) via said second transistor (T2) and said second output terminal of said down-conversion mixing component (33) via said first transistor (T1) to ground (Gnd).